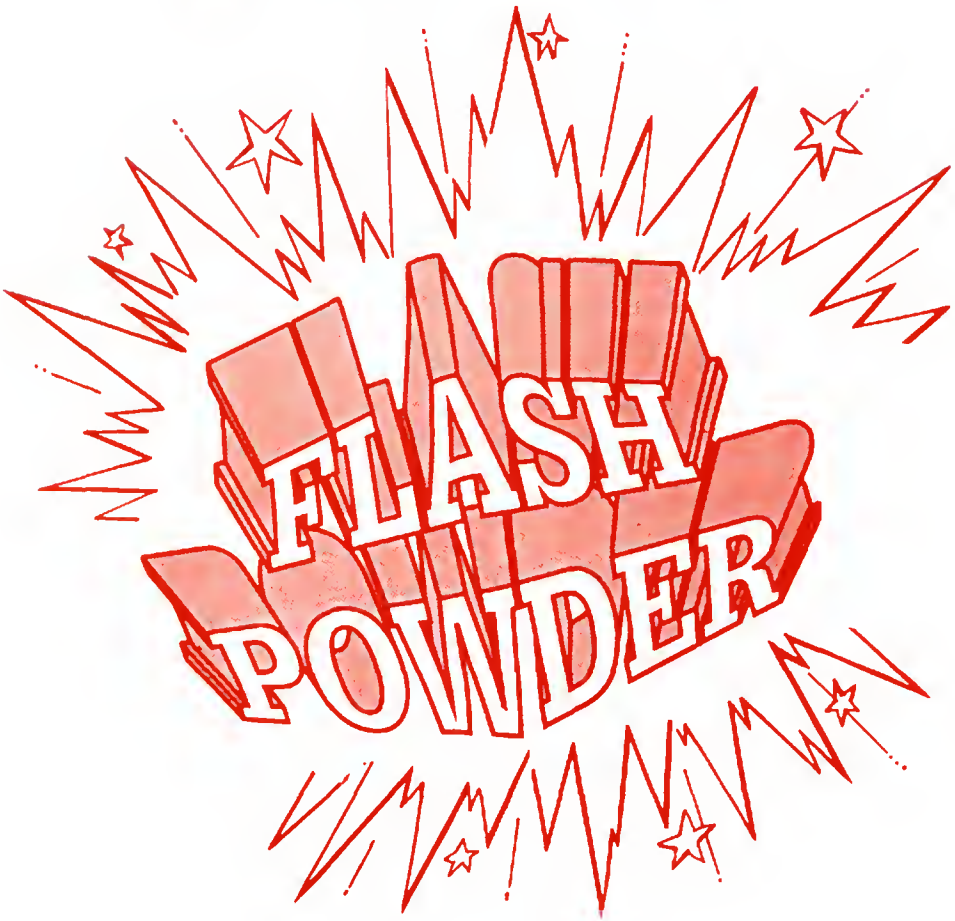
THE COMPLETE BOOK OF



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WARNING NOTICE

THE EXPERIMENTATION OR MANUFACTURING OF FLASH COMPOSITIONS IS VERY DANGEROUS. SEVERE PENALTIES ARE PRESCRIBED FOR VIOLATIONS OF FEDERAL AND STATE LAWS. THIS INFORMATION HAS BEEN PROVIDED FOR RESEARCH AND EDUCATIONAL PURPOSES ONLY.

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ALL INFORMATION, FORMULAS, AND CONSTRUCTION DATA THAT IS OUTLINED IS PRESENTED FOR ACADEMIC STUDY ONLY.

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GENERAL SAFETY

THE FIRST RULE OF CAUTION IS TO NOTE THAT COMPOSITIONS ARE EXTREMELY HAZARDOUS WHEN SUBJECTED TO HEAT, FRICTION, SPARKS, STATIC ELECTRICITY OR A SHARP BLOW. MIXING OR MANUFACTURING FLASH COMPOSITIONS IS POSSIBLY MORE DANGEROUS THAN ATTEMPTING TO MANUFACTURE BLACK POWDER, IMPROVISED PLASTIC OR OTHER NITRATE TYPE EXPLOSIVES.

USING POTASSIUM CHLORATE FORMULAS WITH OR WITHOUT SULPHUR ARE THE MOST DANGEROUS AND HIGHLY UNSTABLE.

THE AMATEUR TECHNICIAN SHOULD FULLY REALIZE THE VIOLENCE, HIGH ENERGY AND CATASTROPHIC RESULTS OF AN ACCIDENTAL FLASH POWDER EXPLOSION. THERE HAS BEEN, IN RECENT TIMES, ACCIDENTAL COMBUSTIONS OF THESE COMPOSITIONS, LEGAL AND ILLEGAL, WHICH RESULTED IN LOSS OF LIFE AND DEVASTATING EXPLOSIONS. COMPLACENCY, CARELESSNESS, FORGETFULNESS OR BLIND TRUST THAT IT HAS NEVER HAPPENED TO ME, WILL ASSIST YOU IN GETTING IN THE CATEGORY OF AN ACCIDENTAL IGNITION OF YOUR COMPOSITION.

A ONE POUND, SLIGHTLY CONTAINED, FLASH MIXTURE PLACED IN A SMALL SHED-TYPE BUILDING, DETONATED ELECTRICALLY,

WILL CAUSE THE FOLLOWING:

1) TOTAL DISAPPEARANCE OF THE SHED
2) A 50 FT. FIREBALL
3) PIECES OF THE SHED BLOWN LIKE MISSILES FOR SEVERAL HUNDRED FEET, AND
4) A SHOCK WAVE THAT WILL BREAK SOME WINDOWS AT 1000 FT.

FLASH POWDERS CONSIST OF FINELY GROUND MATERIALS OF ALUMINUM, MAGNESIUM OR MAGNALIUM. FLASH POWDERS, IN SOME CASES, ACTUALLY INCREASE THE HAZARD OF OTHER MORE DANGEROUS MIXTURES. THE INTRODUCTION OF MOISTURE MAY RENDER MAGNESIUM POWDERS SPONTANEOUSLY COMBUSTIBLE. ALUMINUM POWDER WHEN BURNING HAS A TREMENDOUS ENERGETIC REACTION. ON A UNIT FOR UNIT BASIS VERY FEW FUELS APPROACH ALUMINUM FOR HEAT OR ENERGY OF COMBUSTION.

AN IMPORTANT FACTOR TO REMEMBER IS TIME VS. UNIT COMBUSTION. POWER IS ENERGY PER UNIT TIME. A GIVEN AMOUNT OF GASOLINE NEEDED TO RUN A 1 HP. ENGINE FOR 1/2 HOUR WOULD PRODUCE 2000 HP. EXPLOSION IF BURNED IN 1 SECOND OR A 2 MILLION HP. EXPLOSION IF BURNED IN 1/1000 OF A SECOND. FLASH COMPOSITIONS CONSUME THEIR FUEL IN THOUSANDS AND HUNDREDTHS OF A SECOND.

SINCE THE MAIN ENERGY FACTOR IN FLASH COMPOSITIONS IS ALUMINUM, MOST OXIDIZERS HAVE LITTLE EFFECT ON THE ENERGY OUTPUT OF THE COMPOSITION, BUT THEY HAVE DIFFERENT CHEMICAL PROPERTIES AND CAN CAUSE DIFFERENT PROBLEMS.

ALL ALLUMINUM METAL EXPOSED TO AIR OR MOISTURE IS QUICKLY COATED WITH A TOUGH LAYER OF ALUMINUM OXIDE. IF THIS COATING DID NOT ADHERE STRONGLY TO THE METAL, ALUMINUM ITSELF AS A METAL WOULD BE WORTHLESS OR EVEN DANGEROUS, I.E. ALUMINUM IS NOT FOUND IN NATURE AS RAW ALUMINUM. IT TAKES A GREAT DEAL OF MINING, LIQUID BATHS AND ELECTRICAL ENERGY TO PRODUCE RAW ALUMINUM INGOTS.

DO NOT USE NON-TRADITIONAL BOOSTER MATERIALS WITH FLASH MIXTURES SUCH AS "HDP", "TNT", "DYNAMITE", "KINE-PAC" OR "ASTROLITE B". OR ANY IMPROVISED NITRATE OR PLASTIC MIXTURES.

A GREAT DEAL OF ADDITIONAL RESEARCH MUST BE DONE IN THIS AREA TO SAFELY ASSUME THAT THESE FORMULAS CAN BE USED OR MANUFACTURED IN A LESS HAZARDOUS ENVIRONMENT.

* "TNT"
GENERALLY USED BY THE MILITARY - TRINITROTOLUENE..

THE SAME FORMULAS MIXED BY DIFFERENT PEOPLE IN DIFFERENT LOCATIONS WILL NOT PROVIDE THE SAME SAFETY FACTOR. WHAT HAS OCCURED FOR ONE EXPERIMENTER TIME AND TIME AGAIN, MAY RESULT IN AN ACCIDENTAL EXPLOSION THE FIRST TIME SOMEONE ELSE TRIES TO BLEND THE COMPOSITION.

YOU SHOULD UNDERSTAND THAT THERE ARE SO MANY VARIABLES, MANY UNKNOWNS, AND THAT A DIFFERENT COMBINATION OF THESE VARIABLES FOR THE SAME FORMULA MAY HAVE DISASTROUS RESULTS. AS AN EXAMPLE, FINELY BLENDED FLASH FORMULAS OF THE PUREST AND BEST CHEMICALS HAVE BEEN TESTED AND FOUND TO HAVE "TNT" EQUIVALENCE OF 75% FOR AIR BLAST.

ALUMINUM POWDER HAS AN OXIDE LAYER COATING ON THE SURFACE. WHEN THIS OXIDE COATING IS DISTURBED BY FRICTION, OR BY COMBINING CRYSTALLINE DENSE ADDITIVES TO YOUR COMPOSITION, IT GREATLY INCREASES THE POSSIBILITY OF THE MIXTURE TO DECOMPOSE IMMEDIATELY.

ALUMINUM: ATOMIC WEIGHT; 26.98. PURE ALUMINUM HAS A SPECIFIC GRAVITY OF 2.69. IT MELTS AT 660 DEGREES C. AND BOILS AT ABOUT 2270 DEGREES C.

ALUMINUM POWDER IS USED IN JAPAN IN TWO FORMS: THE FLAKE ALUMINUM WHICH LOOKS BRILLIANT SILVER AND CONSISTS OF SMALL FLAT PLATES, AND THE ATOMIZED ALUMINUM WHICH LOOKS WHITISH GRAY AND CONSISTS OF SPHERICAL OR PEBBLE-LIKE GRAINS. THE LATTER IS LESS IGNITABLE THAN THE FORMER, AND ONLY THE FORMER IS POPULAR IN FIREWORKS.

ALUMINUM IS CHEMICALLY STABLE IN THE AIR, BECAUSE ITS SURFACE IS COVERED BY A FILM OF ALUMINUM OXIDE WHICH PROTECTS ALUMINUM FROM CORROSION.

THE FOUR BASIC TYPES OF ALUMINUM PYRO POWDER AVAILABLE TO THE EXPERIMENTER ARE:

1) SPHERICAL ALUMINUM
2) GRANULAR ALUMINUM
3) ATOMIZED ALUMINUM
4) FLAKE ALUMINUM

SPHERICAL ALUMINUM, AS IT SOUNDS, IS TINY BALLS OF POWDER THAT HAVE THE LEAST AMOUNT OF SURFACE AREA PER

GRAM UNIT. BASICALLY THE LEAST VALUABLE FOR FLASH COMPOSITION PURPOSES.

GRANULAR ALUMINUM - SIMILAR TO GRANULES OF SUGAR OR SALT. THIS TYPE OF ALUMINUM HAS SLIGHTLY MORE SURFACE AREA THAN SPHERICAL BUT WOULD PRODUCE VERY LITTLE MORE IN REACTION PERCENTAGES (NOT PARTICULARLY SUITED FOR FLASH COMPOSITIONS).

ATOMIZED ALUMINUM - CREATED BY BLASTING A HIGH VELOCITY AIR JET INTO MOLTEN ALUMINUM. UNDER A MICROSCOPE THIS ALUMINUM PYRO POWDER SHOWS UP IN ALL DIFFERENT SHAPES AND SIZES SUCH AS MANY ISLANDS ON A LAKE. THIS ALUMINUM CAN BE USED IN FINER MESHES, 320 AND ABOVE, FOR FLASH COMPOSITIONS.

FLAKE ALUMINUM - CREATED IN LARGE BALL MILL INDUSTRIES, UNTIL THE GRANULAR CONSISTENCY IS ROLLED AND POUNDED INTO FLAT MICROSCOPIC PLATELETS. SHINY FLAKE ALUMINUM IN VERY FINE MESH IS EXCELLENT FOR MOST FLASH COMPOSITION FORMULAS.*

* SOME EXPERIMENTS IN FLASH COMPOSITION HAVE BEEN TESTED BY MIXING 70% FLAKE WITH 30% ATOMIZED PRIOR TO ADDING THE OXIDIZER. THE 2 ALUMINUMS MIXED TOGETHER CREATE MICROSCOPIC AIR POCKETS WHICH SEEM TO FACILITATE THE BURNING ACTION. UNLESS THE EXPERIMENTER HAS ACCESS TO BOTH TYPES, IT WOULD NOT BE WORTH HIS TIME TO ENGAGE IN SUCH A VENTURE.

AMMONIUM PERCHLORATE

AMMONIUM PERCHLORATE: MOLECULAR WEIGHT: 117.4 COLORLESS RHOMBIC CRYSTALS, SPECIFIC GRAVITY 1.9 AND IT IS THE LEAST USED OF ALL THE OXIDIZERS IN THE FIREWORK INDUSTRY. IT IS SAID THAT PURE AMMONIUM PERCHLORATE SUBLIMES WITHOUT MELTING WHEN IT IS SLOWLY HEATED IN THE AIR, BUT WHEN WE HEAT THE NORMAL COMMERCIAL MATERIAL IN A PORCELAIN CRUCIBLE WITH AN ELECTRIC HEATER, IT DECOMPOSES VIOLENTLY AT 260-360 DEGREES C.

AMMONIUM PERCHLORATE DISSOLVES IN WATER IN LARGE AMOUNTS EVEN AT ROOM TEMPERATURE.

COMMERCIAL AMMONIUM PERCHLORATE IS SLIGHTLY YELLOWISH. ITS SOLUTION IN WATER IS ALMOST NEUTRAL. IT IS SLIGHTLY SOLUBLE IN ALCOHOL; 2 GRAMS PER 100 GRAMS OF ETHANOL; SOLUBLE IN ACETONE AND INSOLUBLE IN ETHER.

AMMONIUM PERCHLORATE IS A STRONG OXIDIZER AT HIGH TEMPERATURES. IT BURNS WITH SHELLAC, ROSIN, ETC., IN THE RATIO OF ABOUT 10:2 PRODUCING A HIGH TEMPERATURE FLAME. THE BURNING PRODUCTS ARE ALMOST ONLY GASEOUS SUBSTANCES WHICH DO NOT PRODUCE SMOKE IN THE DRY AIR BUT THEY DO SMELL OF HYDROGEN CHLORIDE GAS. HOWEVER,

IN WET AIR A WHITE DENSE SMOKE APPEARS DUE TO THE CHLORIDE GAS.

AMMONIUM PERCHLORATE FORMULAS WILL YIELD EXTREMELY HIGH FLASH AND SHOCK WAVES EVEN THOUGH MORE DIFFICULT TO IGNITE.

AMMONIUM PERCHLORATE ALONE EXPLODES WITH A STRONG IMPACT, BUT IT SHOWED NO TENDENCY TO EXPLODE WHEN INITIATED BY A NO. 6 DETONATOR.

AMMONIUM PERCHLORATE REACTS WITH MAGNESIUM IN THE PRESENCE OF MOISTURE OR WATER TO PRODUCE AMMONIA GAS AND MAGNESIUM PERCHLORATE. THE REACTION CAN BE DETECTED BY THE SMELL OF AMMONIA. IN THIS CASE, A LARGE AMOUNT OF HEAT IS GENERATED, OFTEN ENOUGH TO CAUSE A FIRE DUE TO THE ACCUMULATION OF HEAT. BUT UNDER PERFECTLY DRY CONDITIONS THIS REACTION DOES NOT OCCUR.

IF A COMPOSITION WHICH CONTAINS AMMONIUM PERCHLORATE COMES IN CONTACT WITH ANOTHER COMPOSITION WHICH CONTAINS POTASSIUM NITRATE SUCH AS BLACK POWDER, A WET LAYER OF AMMONIUM NITRATE OCCURS BETWEEN THE TWO COMPOSITIONS AND CAUSES MISFIRE.

*<u>NEEDLESS TO SAY COMPOSITIONS WHICH CONTAIN AMMONIUM PERCHLORATE AND POTASSIUM CHLORATE MUST BE AVOIDED.</u>

ANTIMONY TRISULPHIDE

ANTIMONY TRISULPHIDE: MOLECULAR WEIGHT - 339.7. IT IS STABLE IN THE FORM OF RHOMBIC PRISMATIC CRYSTALS, WHICH HAVE A BLACK GREY METALLIC LUSTRE. IT HAS A SPECIFIC GRAVITY OF 4.6; MELTS AT 548 DEGREES C.; DISSOLVES IN ALKALI SULPHIDE.

A MIXTURE OF ANTIMONY TRISULPHIDE AND AN OXIDIZER IS GENERALLY SENSITIVE TO SHOCK AND FRICTION. ROUGHLY SPEAKING, ANTIMONY TRISULPHIDE IS LESS SENSITIVE THAN SULPHUR TO SHOCK, BUT IT HAS A HIGHER FRICTION SENSITIVITY THAN SULPHUR.

ANTIMONY TRISULPHIDE WITH POTASSIUM CHLORATE IS SENSITIVE TO BOTH SHOCK AND FRICTION; WITH POTASSIUM PERCHLORATE IT IS SENSITIVE TO FRICTION, BUT QUITE INSENSITIVE TO SHOCK; WITH AMMONIUM PERCHLORATE, ON THE CONTRARY, INSENSITIVE TO FRICTION, BUT SENSITIVE TO SHOCK AS IN THE CASE OF CHLORATE; WITH POTASSIUM NITRATE IT IS INSENSITIVE TO BOTH, SHOCK AND FRICTION.

ANTIMONY TRISULPHIDE HAS BEEN USED AS THE MOST ACTIVE SENSITIZER IN FLASH COMPOSITION. WHEN MIXING A FLASH COMPOSITION WITH ANTIMONY TRISULPHIDE AS PART OF THE

FORMULA, KEEP IN MIND THE CRYSTALLINE FORM HAS A TENDENCY TO BE ABRASIVE TO THE ALUMINUM OXIDE COATING IN MIXING. THIS OVER-REACTION COULD CAUSE INSTANT IGNITION.

MIX VERY CAREFULLY...

BARIUM NITRATE

BARIUM NITRATE: 261.3 COLORLESS TESSERAL CRYSTALS, SPECIFIC GRAVITY 3.2 WHICH IS 1.1 TIMES LARGER THAN THAT OF STRONTIUM NITRATE, 1.5 TIMES THAT OF POTASSIUM NITRATE AND 1.3 TIMES THAT OF POTASSIUM PERCHLORATE. THE MELTING POINT IS 592 DEGREES C., BUT COMMERCIAL SAMPLES WILL MELT AT 552 DEGREES C.

BARIUM NITRATE IS SOLUBLE IN WATER. POWDERED BARIUM NITRATE CAKES TO FORM A VERY HARD MASS ALMOST LIKE STONE AND THUS CAUSES CONSIDERABLE INCONVENIENCE.

BARIUM NITRATE ALONE CANNOT BE IGNITED OR CAUSED TO EXPLODE EVEN BY A STRONG IMPACT. A MIXTURE OF BARIUM NITRATE AND SHELLAC IN THE WEIGHT RATIO OF 10:2 BURNS WELL PRODUCING A SLIGHT GREEN COLORED FLAME.

THE OXYGEN PRODUCED IN THE FORMER CASE AMOUNTS TO 0.061 GRAMS AND IN THE LATTER CASE TO 0.184 GRAMS PER GRAM OF BARIUM NITRATE.

MAGNALIUM

MAGNALIUM: IS AN ALLOY OF ALUMINUM AND MAGNESIUM. IT IS A SILVER MASS, WHICH IS EASILY CRUSHED TO POWDER WITH AN IRON MORTAR. THE MAGNALIUM POWDER WHICH IS OBTAINED IN COMMERCE AT PRESENT CONTAINS 50% ALUMINUM AND 50% MAGNESIUM. ITS SPECIFIC GRAVITY IS ABOUT 2.0. IT MELTS AT ABOUT 460 DEGREES C. WE CALL IT 50/50 MAGNALIUM.

MAGNALIUM IS ALSO ATTACKED BY VARIOUS SALTS IN THE WET STATE OR IN THE PRESENCE OF MOISTURE, BUT THE DEGREE OF ATTACK LIES IN GENERAL BETWEEN THOSE OF ALUMINUM AND MAGNESIUM.

MAGNESIUM

MAGNESIUM: ATOMIC WEIGHT; 24.3. PURE MAGNESIUM HAS A SPECIFIC GRAVITY OF 1.7. IT MELTS AT 650 DEGREES C. AND BOILS AT 1107 DEGREES C. MAGNESIUM IS LIGHTER THAN ALUMINUM IN SPECIFIC GRAVITY, HAS THE SAME MELTING POINT AND A LOWER BOILING POINT. MAGNESIUM BURNS WELL IN COMBINATION WITH AN OXIDIZER, EVEN IF THE OXYGEN CONTENT IS NOT ENOUGH FOR COMPLETE COMBUSTION, BECAUSE MAGNESIUM IS EASILY VAPORIZED AND BURNS AS A LARGE LONG FLAME CATCHING THE OXYGEN IN THE AIR.

THE AMOUNT OF COMBUSTION HEAT PER 1 GRAM OF MAGNESIUM IS 6000 KCAL: IT IS NOT AS HIGH AS THAT OF ALUMINUM.

MAGNESIUM POWDER IS SLOWLY OXIDIZED AT THE SURFACE AND LOSES ITS METALLIC LUSTRE. COLD WATER REACTS VERY SLOWLY WITH MAGNESIUM, BUT IT IS QUITE ACTIVE WITH HOT WATER.

AT THE ROOM TEMPERATURE, ALCOHOL OR ACETONE DOES NOT REACT WITH MAGNESIUM, BUT THEY REACT SLOWLY WITH HEAT.

MAGNESIUM IS VIOLENTLY ATTACKED BY VARIOUS KINDS OF ACID AND EVEN BY A WEAK ACID, E.G. BORIC ACID OR ACETIC ACID. THIS IS QUITE A DIFFERENT PROPERTY FROM ALUMINUM.

POTASSIUM CHLORATE

POTASSIUM CHLORATE: $KClO_3$, MOLECULAR WEIGHT 122.5, COLORLESS MONOCLINIC CRYSTALS. SPECIFIC GRAVITY 2.33. MELTING POINT 368 DEGREES C.

POTASSIUM CHLORATE IS A STRONGER OXIDIZER AT HIGH TEMPERATURES. IT BURNS IN COMBINATION WITH FUELS, SHELLAC AND ROSIN PRODUCING A HIGH TEMPERATURE FLAME AND WHITE SMOKE OF KC-1 PARTICLES.

POTASSIUM CHLORATE ALONE EXPLODES WITH A STRONG IMPACT BUT NOT WHEN INITIATED BY A NO. 6 DETONATOR. WHEN IT IS MIXED WITH SULFUR OR ANTIMONY TRI-SULPHIDE, THE SENSITIVITY TO SHOCK OR FRICTION IS HIGHLY INCREASED. IT WOULD BE IDEAL TO REJECT THIS MATERIAL FROM FIREWORKS, BUT IT IS QUITE DIFFICULT BECAUSE NO OTHER OXIDIZER CAN SURPASS POTASSIUM CHLORATE IN BURNING SPEED, EASE OF IGNITION OR NOISE MAKING ABILITY. ONE MUST TREAT POTASSIUM CHLORATE COMPOSITIONS WITH GREAT RESPECT AND CAUTION.

POTASSIUM PERCHLORATE

POTASSIUM PERCHLORATE: 138.5 COLORLESS RHOMBIC CRYSTALS, SPECIFIC GRAVITY 2.5, AND THIS HIGH VALUE IS WORTH NOTING. IT MAKES A TRANSITION TO THE TET-RAGONAL SYSTEM AT ABOUT 300 DEGREES C. THE MATERIAL ON THE MARKET MELTS AT ABOUT 570 DEGREES C. AT THIS TEMPERATURE IT DECOMPOSES GENERATING OXYGEN.

POTASSIUM PERCHLORATE IS ALMOST NON-HYGROSCOPIC; BUT AN EXPERIMENT SHOWED THAT IT ABSORBED 6% MOISTURE IN AN ATMOSPHERE WITH 100% RELATIVE HUMIDITY AT ORDINARY TEMPERATURE DURING TEN DAYS.

CRUSHED POTASSIUM PERCHLORATE POWDER CAKES GRADUALLY DURING STORAGE, BUT IT DOES NOT BECOME AS HARD AS POTASSIUM NITRATE OR POTASSIUM CHLORATE.

POTASSIUM PERCHLORATE ALONE EXPLODES WITH A STRONG IMPACT, BUT ON THE DETONATOR TEST NO EXPLOSION OCCURS.

POTASSIUM PERCHLORATE IS A STRONG OXIDIZER AT HIGH TEMPERATURES. IT IS THE SAME AS POTASSIUM CHLORATE IN THAT IT BURNS WITH A FUEL SUCH AS ROSIN IN A MIXTURE OF ABOUT 10:2 RATIO, PRODUCING A HIGH TEMPERATURE FLAME AND A WHITE SMOKE OF KCl PARTICLES.

POTASSIUM PERCHLORATE IS FAR LESS LIKELY TO DECOMPOSE IN ULTRA-VIOLET LIGHT THAN THE CHLORATE, I.E. 1/10 THE LATTER.

PERCHLORATE IS THE MOST COMMONLY PREFERRED OXIDIZER IN FLASH COMPOSITION. IT IS MUCH SAFER TO USE AND CAN STILL BE IGNITED UNDER NORMAL CONDITIONS. DO NOT GET CARELESS BECAUSE THIS CHEMICAL IS CONSIDERED SAFER.

POTASSIUM CHLORATE OR SODIUM CHLORATE REACTS RATHER ACTIVELY ON MAGNESIUM: POTASSIUM PERCHLORATE LESS

ACTIVELY THAN THE ABOVE: POTASSIUM NITRATE VERY SLOWLY AND AT ROOM TEMPERATURE IT LOOKS AS IF NO REACTION OCCURS AT ALL; BARIUM NITRATE, STRONTIUM NITRATE OR POTASSIUM BICHROMATE CAUSE NO REACTION.

IT HAS ALREADY BEEN SUGGESTED THAT THE ABOVE REACTIONS DO NOT OCCUR IN PRACTICE IF THE MATERIALS ARE WELL DRIED. THEREFORE COMPOSITIONS WHICH CONTAIN MAGNESIUM AS A COMPONENT MUST BE KEPT VERY DRY IF THEY ARE TO BE STORED FOR A LONG TIME.

SULPHUR

SULPHUR: ATOMIC WEIGHT; 32.06. THERE ARE TWO TYPES OF SULPHUR. FLOWERS OF SULPHUR WHICH IS MADE FROM RAW SULPHUR BY DISTILLATION CONTAINS SULPHURIC ACID AND IS NOT USED FOR FIREWORKS OR FLASH COMPOSITIONS. NATURAL SULPHUR, SEPARATED FROM THE EARTH AND CRUSHED INTO POWDER AS NATURAL CRYSTALS, REFERRED TO AS "SULPHUR FLOUR" IS USED PRIMARILY FOR ALL PYROTECHNIC PURPOSES.*

THE SULPHUR USED AT ORDINARY TEMPERATURE AND PRESSURE IS D, WHICH HAS YELLOWISH RHOMBIC CRYSTALS AND HAS A SPECIFIC GRAVITY OF 2.07. D SULPHUR MAKES A TRANSITION

* IF ACCIDENTLY YOU USE "FLOWERS OF SULPHUR" WITH POTASSIUM CHLORATE, YOU ARE LOOKING FOR AN IMMEDIATE EXPLOSION.

TO B SULPHUR AT 95.5 DEGREES C. B SULPHUR HAS YELLOW BROWN MONOCLINIC CRYSTALS, WITH A MELTING POINT OF 118.95 DEGREES C AND A SPECIFIC GRAVITY OF 1.96.

SULPHUR DOES NOT CONDUCT ELECTRICITY BUT IT IS EASILY ELECTRIFIED. FOR FIREWORK USE THE SULPHURIC ACID CONTENT MUST BE LOW ESPECIALLY IF IT IS USED IN COMBINATION WITH CHLORATE.

SULPHUR IGNITES AT 223 DEGREES C. IN THE AIR. THIS RELATIVELY LOW IGNITION TEMPERATURE IS OFTEN USED FOR FIREWORK COMPOSITIONS FOR EASE OF IGNITION. SULPHUR IS USED AS A RAW MATERIAL FOR BLACK POWDER IN COMBINATION WITH POTASSIUM NITRATE AND CHARCOAL AND IT IS ALSO USED FOR WHITE SMOKE COMPOSITIONS.

THE COMPOSITION WHICH CONTAINS SULPHUR AND SOME OXIDIZER IS GENERALLY SENSITIVE TO SHOCK AND FRICTION. THE HIGHEST DEGREE OF SENSITIVITY IS IN COMBINATION WITH CHLORATE; NEXT WITH AMMONIUM PERCHLORATE; WITH POTASSIUM PERCHLORATE THE THIRD; AND WITH NITRATES LESS SENSITIVE THAN ABOVE. WITH ANY OXIDIZER, SULPHUR GIVES A HIGHER IGNITION SENSITIVITY THAN CHARCOAL.

LAMPBLACK: IS OBTAINED BY THE INCOMPLETE BURNING OF PINE WOOD, AND CONSISTS OF VERY FINE EASILY SCATTERED PARTICLES. IT IS NOT SOLUBLE IN WATER AND WILL FLOAT ON TOP. AS A COMPONENT OF BLACK POWDER IT PRODUCES A LARGE FORCE OF EXPLOSION.

CARBON BLACK HAS BEEN USED IN SEVERAL FLASH FORMULAS AS A DE-SENSITIZER IN STATIC ELECTRICAL PROBLEMS.

MEAL POWDER: THIS MATERIAL IS WIDELY USED IN FIRE-WORKS DISPLAYS. IT IS ALSO USED FOR MATCH AND PRIMING, AND MOISTENS MORE QUICKLY THAN GRAIN POWDER. IT IS DIFFICULT TO OBTAIN OUTSIDE OF LARGE CITIES. THE CHEMICAL FORMULA FOR THE COMPOSITION IS AS FOLLOWS:

SALTPETER, (POTASSIUM NITRATE)	-	15 PARTS
CHARCOAL	-	3 PARTS
SULPHUR FLOUR	-	2 PARTS

GRIND FINELY EACH INDIVIDUAL CHEMICAL PRIOR TO MIXING. CLEAN MORTAR THOROUGHLY BETWEEN CHEMICALS. MIX IN A VENTILATED AREA WITH A NON-SPARKING METALLIC SPATULA SLOWLY. MIX SMALL AMOUNTS AND TREAT THIS MIXTURE AS YOU WOULD ANY EXPLOSIVE MIXTURE. REFER TO THE SAFETY CHAPTERS ON MIXING AND PROCEDURES BEFORE ATTEMPTING THIS COMPOSITION. BE AWARE OF DUST CLOUDS AND STATIC ELECTRICITY WHILE MIXING THIS COMPOSITION.

FLASH FORMULAS

AMMONIUM BLACK POWDER

AMMONIUM NITRATE	90%
CHARCOAL (FINE)	6
PYRO ALUMINUM	4

****

SALUTE POWDER

BLACK MEAL POWDER	83%
POTASSIUM PERCHLORATE	12
PYRO ALUMINUM	5

****

GENERAL PURPOSE FLASH POWDER

ALUMINUM	1 PART
BARIUM NITRATE	3.5
SULPHUR FLOUR	1/2

NOTE: THIS IS A VERY STABLE AND FRICTION RESISTANT COMPOSITION WHICH CAN BE USED SUCCESSFULLY IN THIN WALLED TUBES.

****

CLARK FORMULA (1)

ALUMINUM FLAKE	5 PARTS
POTASSIUM PERCHLORATE	7

NOTE: THIS IS A VERY GOOD HIGH VELOCITY MIX.

****

LARGE SALUTE FORMULA (1)

POTASSIUM PERCHLORATE	12 PARTS
SULPHUR FLOUR	8
SAWDUST (FINE)	1

NOTE: SLOW BURNING. THIS IS AN EXCELLENT COMPOSITION FOR LARGE AERIAL BOMBS.

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LARGE SALUTE FORMULA (2)

POTASSIUM PERCHLORATE	6 PARTS
SULPHUR FLOUR	2
ANTIMONY TRISULPHIDE	3

NOTE: THIS IS FASTER BURNING HIGH INTENSITY FLAME COMPOSITION WITH ANTIMONY TRISULPHIDE AS A SENSITIZER.

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LARGE SALUTE FORMULA (3)

POTASSIUM PERCHLORATE	32 PARTS
CHARCOAL	3
ROSIN	3

NOTE: SLOW BURNING COMPOSITION FOR THICK WALLED AERIAL BOMBS AND OTHER APPLICATIONS.

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STANDARD SALUTE MIX

POTASSIUM PERCHLORATE	66
PYRO ALUMINUM	34

****

ALTERNATIVE NO. 1

BARIUM NITRATE	4 PARTS
PYRO ALUMINUM	2
SULPHUR FLOUR	1

NOTE: COMPOSITION STORAGE AFTER MIXING IS EXCELLENT ON THIS FORMULA.

****

ALTERNATIVE NO. 2

POTASSIUM PERCHLORATE	12 PARTS
SULPHUR	8
SAWDUST (FINE)	1

NOTE: THIS COMPOSITION DOES NOT STORE AS WELL BUT CREATES A MORE VIOLENT EXPLOSION. ADDITIONALLY IT IS THE ONLY REALLY GOOD FORMULA FOR FLASH POWDER, WHICH DOES NOT REQUIRE ALUMINUM.

****

CLARK FORMULA (2)

ALUMINUM FLAKE	5 PARTS
BARIUM NITRATE	3
POTASSIUM PERCHLORATE	6

****

CANNON FORMULA (1) (SAFEST)

POTASSIUM PERCHLORATE	6 PARTS
SULPHUR FLOUR	3
CHARCOAL	1

NOTE: AN EXPLOSIVE FORMULA NOT FOR USE IN FIREARMS.

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ALTERNATIVE CANNON FORMULA

POTASSIUM PERCHLORATE	12 PARTS
SULPHUR FLOUR	2
POTASSIUM NITRATE	1
ANTIMONY TRISULPHIDE	1/2

NOTE: THIS IS THE LOUDEST FORMULA FOR THICK-WALLED OR LARGE AERIAL MAROONS.

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MILITARY M-80 FORMULA

MAGNESIUM 320 MESH OR FINER	1 PART
ALUMINUM FLAKE 320 MESH OR FINER	1
POTASSIUM PERCHLORATE	1

NOTE: THIS IS THE ORIGINAL MILITARY "M-80" SIMULATOR FORMULA. SLOW BURNING, HARD TO IGNITE. MUST BE EXCEPTIONALLY WELL CONTAINED.

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PYROTECHNIC FORMULA 1

POTASSIUM PERCHLORATE	2 PARTS
ALUMINUM	1
SULPHUR FLOUR	1

NOTE: THIS IS AN EXCELLENT MEDIUM SPEED FLASH COMPOSITION FOR MOST MIDDLE RANGE APPLICATIONS.

****

PYROTECHNIC FORMULA 2

POTASSIUM PERCHLORATE	2 PARTS
ALUMINUM FLAKE	1
FUMED SILICA POWDER	1/10

NOTE: LESS SENSITIVE TO IMPACT AND STATIC BUILD-UP THAN MOST OTHER FORMULAS. HIGH VELOCITY MIX FOR USE IN THIN WALLED TUBES.

****

COMMERCIAL SALUTE MIX

BARIUM NITRATE	68%
PYRO ALUMINUM	23
SULPHUR FLOUR	9

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CHINESE FORMULA NO. 1

POTASSIUM PERCHLORATE	3 PARTS
PYRO ALUMINUM	4
SULPHUR FLOUR	3

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CHINESE FORMULA NO. 2

POTASSIUM NITRATE	5 PARTS
PYRO ALUMINUM	2
SULPHUR FLOUR	3

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CHINESE FORMULA NO. 3

POTASSIUM NITRATE	5 PARTS
SULPHUR FLOUR	3
PYRO ALUMINUM	2
POTASSIUM PERCHLORATE	1

NOTE: THIS IS A VERY HOT MIX AND CAN BE USED FOR MANY THIN WALL APPLICATIONS.

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EXPERIMENTAL FORMULA 1

ALUMINUM FLAKE 400 MESH OR UP	50%
ALUMINUM ATOMIZED (320 MESH OR UP)	20%
POTASSIUM PERCHLORATE	25%
ANTIMONY TRISULPHIDE	5%

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EXPERIMENTAL FORMULA 2

ALUMINUM ATOMIZED (320 MESH OR UP)	62%
POTASSIUM PERCHLORATE	30%
ANTIMONY TRISULPHIDE	8%

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WE HAVE INCLUDED ALL OF THESE FORMULAS SO THAT THE THEORIST OR EXPERIMENTER WHO CANNOT OBTAIN CERTAIN OF THE CHEMICALS LISTED MAY AT LEAST AVAIL HIMSELF OF THE USE OF SOME OF THE FORMULAS WITHOUT UNDUE DIFFICULTY. A GREAT DEAL OF RE-READING THE SAFETY INSTRUCTIONS AND MIXING METHODS SHOULD BE EXERCISED PRIOR TO ATTEMPTING ANY OF THESE FORMULAS.

SAFETY PROCEDURES

THIS CHAPTER WILL DEAL IN DEPTH WITH THE SAFETY FACTORS. ALWAYS READ THIS SAFETY CHAPTER PRIOR TO MIXING OR EXPERIMENTING WITH ANY CHEMICAL COMPOSITIONS.

OBVIOUSLY, SMOKING IN A WORK OR STORAGE AREA CAN BE FATAL.

THE AREA USED FOR MIXING FLASH COMPOSITIONS SHOULD BE CLEAN, VENTILATED AND REMOTE FROM ADJACENT AREAS, WHICH MAY CONTAIN ELECTRONIC DEVICES, PEOPLE ENGAGED IN VARIOUS HOUSEHOLD ACTIVITIES. QUIET SURROUNDINGS OF LOW ACTIVITY WITH AN ATMOSPHERE THAT WOULD ALLOW COMPLETE CONCENTRATION SHOULD BE SOUGHT. AN ADJACENT SMALL BUILDING OR GARAGE IS AN EVEN BETTER SITUATION.

THE EXPERIMENTER SHOULD WEAR COTTON CLOTHING AND REMOVE ALL METALLIC ITEMS SUCH AS RINGS, WATCHES, METAL BELT BUCKLES, ETC. IT IS ADVISABLE TO WEAR LATEX GLOVES, SAFETY GLASSES OR GOGGLES, AND A BREATHING RESPIRATOR, IF POSSIBLE.

STATIC ELECTRICITY: IS THE MOST HAZARDOUS PROBLEM THE PYRO-TECHNICIAN FACES WHEN MIXING THESE COMPOSITIONS. A DRY CLIMATE WITH LOW HUMIDITY OR A WINTER

SEASON WHERE THE BUILDING IN USE IS HEATED, WILL LOWER THE HUMIDITY, INCREASES THE CHANCES OF STATIC SPARK. PROFESSIONAL AND ADVANCED AMATEURS EVEN GO SO FAR AS TO WEAR A GROUND STRAP ON THEIR WRIST WHILE MIXING THESE FORMULAS.

THOROUGHLY REVIEW THE STEP BY STEP PROCEDURE AND FORMULA PRIOR TO INITIATING YOUR MIXING PROCESS. MANUFACTURING OR MIXING FLASH FORMULAS ON DRY COLD DAYS OF LOW HUMIDITY INCREASES THE STATIC ELECTRICAL POTENTIAL. (A HAZARDOUS EXPLOSION.)

CONCENTRATION AND A QUIET ENVIRONMENT CANNOT BE EMPHASIZED ENOUGH. AVOID STARTING YOUR MIXING PROCEDURE IF INTERRUPTIONS COULD RESULT IN DISTURBING YOUR CONCENTRATION.

AS A SAFETY PRECAUTION, IN CASE OF AN ACCIDENTAL COMBUSTION, AVOID USING GLASS OR METAL CONTAINERS BECAUSE OF THE SHRAPNEL EFFECT. CHEMICALS INCLUDING YOUR BASIC COMPONENTS AND MIXED COMPOSITION SHOULD BE STORED IN STRONG PLASTIC LABELED CONTAINERS, IN SEPARATE AREAS. DO NOT STORE INDIVIDUAL CHEMICALS IN YOUR WORK AREA. ALWAYS AVOID MIXING COMPOSITIONS

OR STORING THESE CHEMICALS IN AREAS WITH ELECTRICAL EQUIPMENT OF ANY KIND. IF YOU ARE INTERRUPTED DURING YOUR MIXING PROCEDURE, CLOSE OR COVER ALL CONTAINERS BEFORE LEAVING THE AREA.***

KEEP IN MIND THE PROXIMITY OF OTHER CHEMICALS, AS THE POSSIBILITY EXISTS OF A SYMPATHETIC EXPLOSION, IF YOU HAVE AN ACCIDENT.

SHOULD YOU SPILL ANY OF THE CHEMICALS OR THE MIXED COMPOSITIONS ON YOUR MIXING PLATFORM OR DESK, CLEAN UP IMMEDIATELY BEFORE PROCEEDING. IF YOUR SKIN BECOMES CONTAMINATED OR IRRITATED WITH ANY OF THE CHEMICALS OR COMPOSITION MIXTURES, WASH IMMEDIATELY WITH CLEAN WATER AND THEN DRY BEFORE PROCEEDING.

*** DO NOT MIX ANY AMMONIUM CHEMICAL FORMULAS WITH ANY COMPOSITIONS CONTAINING POTASSIUM CHLORATE OR PERCHLORATE AS A DANGER OF SPONTANEOUS COMBUSTION IS EXTREMELY GREAT.

MANUFACTURING & PREPARATION OF CHEMICAL FORMULAS

THE DRY PROCESS

FLASH
COMPOSITION IS PROBABLY THE MOST SPELLBINDING, CONSIDERING ALL OF THE FORMULAS AVAILABLE FOR FLASHPOWDER, AND CERTAINLY RANKS VERY HIGH ON THE DANGER LIST. THIS IS DUE TO THE HIGH ENERGY AND AWESOME RESULTS OF ITS EFFECTS.

A BLINDING WHITE FLASH FOLLOWED BY A TREMENDOUS PRESSURE WAVE ADDS TO THE DESTRUCTIVE FORCE OF THESE SIMPLE FORMULAS. A GOOD QUALITY FLASH HAS A CRITICAL MASS OF APPROXIMATELY 2 OZS., WHICH MEANS IT WOULD DETONATE IN OPEN AIR, UNCONTAINED, WHEN IGNITED. A SMALLER AMOUNT WILL BURN VIOLENTLY, BUT WITH NO REPORT OR CONCUSSION WAVE.***

CHEMICALS USED FOR THE VARIOUS FORMULAS MUST BE OF GOOD PURITY AND EXTREMELY FINE MESH. THE LARGER THE MESH NUMBER, THE FINER THE PARTICLE SIZE.

*** IT TAKES APPROXIMATELY 500 LBS. OF BLACK POWDER TO FORM AN OPEN AIR CRITICAL MASS EXPLOSION...

MOST CHEMICALS ARE GROUND BY VARYING METHODS, AND SIFTED THROUGH METAL SCREENS. PARTICLES SMALL ENOUGH TO PASS THROUGH A PARTICULAR MESH SCREEN WILL END UP IN THE CONTAINER AND BE GRADED ACCORDINGLY. AMATEUR PYRO-TECHNICIANS WHO DO NOT HAVE SCREENS AVAILABLE, USE RELATIVELY COARSE PARTICLES FOR EXPERIMENTATION.

MOST OXIDIZERS TEND TO CAKE AND FORM LUMPS DURING STORAGE OR WHEN THEY ARE SUBJECTED TO MEDIUM TO HIGH HUMIDITY. STORE OXIDIZERS IN TIGHT PLASTIC CONTAINERS. BUY IN LIMITED QUANTITIES, IF POSSIBLE.

TO PREPARE OXIDIZERS, (POTASSIUM PERCHLORATE), FOR MIXING USE, WEIGH OUT THE DESIRED AMOUNT FOR THE FORMULA YOU ARE GOING TO FOLLOW. THE SIMPLEST TECHNIQUE IS TO GRIND THE CHEMICAL IN A MORTAR AND PESTLE. THIS DEVICE, GLASS OR CERAMIC, IS GENERALLY AVAILABLE AT A LOCAL DRUG-STORE. IF YOU CANNOT OBTAIN ONE OF THESE LOW PRICED UNITS, YOU MAY USE A PIECE OF FORMICA AND A HARDWOOD DOWEL. THE MOST SATISFACTORY METHOD OF TURNING LUMPY GRANULAR POWDER INTO A FLOUR-LIKE SUBSTANCE IS TO OBTAIN OR BUILD A SCREEN FIXTURE. FINE MESH, BRASS OR STAINLESS SCREEN, APPROXIMATELY ONE FT. SQUARE, FASTENED TO A WOOD FIX-TURE, WILL ENABLE THE EXPERIMENTER TO GRIND THE MIX-TURE THROUGH THE SCREEN ON TO A BROWN KRAFT PAPER TO

A FLOUR-LIKE CONSISTENCY.

AN INVENTIVE TECHNICIAN MUST FIND SOME WAY OF GRINDING THE OXIDIZERS INTO AS FINE A POWDER AS POSSIBLE IF THE ABOVE DEVICES ARE NOT AVAILABLE. THE FINER THE POWDER IS GROUND, THE BETTER THE COMPOSITION WILL REACT.

THE MOST ASKED QUESTION CONCERNING FLASHPOWDER IS: "HOW CAN I MIX IT SAFELY, AND WHAT IS THE BEST MIXING METHOD?"

ONE OF THE MORE SAFER METHODS THAT HAS BEEN USED IS THE USE OF A NATURAL BRISTLE BRUSH. PREFERABLY ANIMAL BRISTLE. AND A SHEET OF CLEAN PAPER. A SMALL BATCH, 1-2 OZ. TOTAL, CAN BE DONE WITH AN ARTIST'S BRUSH. A LARGE BATCH MAY BE MIXED WITH A VARNISH OR SASH BRUSH.

SIFTING THE OXIDIZER OVER THE ALUMINUM IS ONE METHOD. THEN USING THE BRUSH AT AN ANGLE, VERY GENTLY PUSH THE FIBER BRUSH INTO THE ALUMINUM AND THE ENTIRE BATCH. THIS SHOULD BE SLOWLY STIRRED AND FOLDED BACK AND FORTH WITH THE BRUSH SEVERAL TIMES. A UNIFORM MIX WILL RESULT IN A SHORT LENGTH OF TIME. THIS METHOD TAKES ADVANTAGE OF THE HUNDREDS OF FIBERS OF

SOFT FLEXIBILITY OF THE BRUSH WITH SUFFICIENT RIGIDITY TO ACT AS MANY STIRRING STICKS.

SOFT PLASTIC TAPE SHOULD BE PLACED, PRIOR TO THIS PROCEDURE, AROUND THE METAL RETAINING BAND.

DO NOT STRIKE THE HANDLE OR EDGE OF THE BRUSH TO CLEAN POWDER FROM THE BRISTLES. THE BRUSH MAY BE CLEANED BY GENTLY RUNNING THE BRISTLES ACROSS A WOOD PENCIL SEVERAL TIMES SO IT FANS OUT AND GENTLY DROPS TO THE LARGER MIXTURE. ALWAYS PROCEED CAUTIOUSLY, SLOWLY AND GENTLY, WHEN COMBINING ANY OXIDIZER WITH ALUMINUM, OR MAGNESIUM POWDERS.

A SECOND METHOD IS TO PLACE THE WEIGHED AMOUNT OF THE FORMULA ON A PIECE OF CLEAN NEWSPAPER, AND THE OTHER PART OF THE FORMULA SOME 10" AWAY. PICK UP THE OPPOSING CORNER, GENTLY, IN A WAVE MOTION, ROLL ONE MEDIUM INTO THE OTHER BACK AND FORTH AND SO ON. AGAIN I STRESS SLOWLY, SLOWLY, SLOWLY.

LARGER BATCHES

A RUBBER TUMBLER WITH END PLUGS HAS BEEN USED SUCCESSFULLY WITH A VERY SLOW REVOLVING MOTION (2-5 REVOLUTIONS PER MINUTE).

THE CHINESE AND MORE RECENT FIREWORKS SALUTE MANUFACTURERS EMPLOY THE USE OF AN ALL WOOD TUMBLER AT ABOUT 5 REVOLUTIONS PER MINUTE.

MIXING 10 AND 20 LB. BATCHES, AND MORE, BOTH OF THESE LAST TWO METHODS ARE DONE OUTSIDE IN A SMALL BUILDING WITH NO ONE PRESENT. IN OTHER WORDS, THE MATERIAL IS PLACED CAREFULLY IN THESE STYLE TUMBLERS AND THEY ARE CAPPED, AND A REMOTE ELECTRIC SWITCH IS TURNED ON AS THE PERSON VACATES THE AREA. AT A GIVEN TIME, BASED UPON PAST EXPERIENCE, THE SWITCH IS TURNED OFF AND THE MIXTURE IS ALLOWED TO SETTLE AND THEN REMOVED CAREFULLY WITH THE PROPER UTENSILS FOR CONSTRUCTIVE USE.

BEAR IN MIND THAT A 4 OZ. 3" SALUTE HELD IN YOUR HAND, WHEN FIRED, WOULD REMOVE PART OF YOUR ARM, AND POSSIBLY CAUSE SEVERE HEAD, EYE AND EAR DAMAGE.

SMALL BATCHES

THE FOLLOWING PROCEDURE IS USED FOR 1-2 LB. BATCH OF FLASH COMPOSITION.

CAREFULLY WEIGH THE OXIDIZER AND PLACE IN A LARGE PLASTIC BOWL OFF TO ONE SIDE, IF POSSIBLE. PLACE THE MEASURED AMOUNT OF THE FLAMMABLE SOLID ON THE OPPOSITE SIDE WITH A NATURAL BRISTLE BRUSH, PLASTIC SPATULA OR A WOOD STIRRING SPOON. SLOWLY AND CAREFULLY BLEND IN THE INGREDIENTS FOR APPROXIMATELY 1-2 MINUTES. CHECK THE SIDES SO THAT A MIXTURE BUILD-UP DOES NOT OCCUR.

ALWAYS REMEMBER STATIC ELECTRICITY.

WET PROCESS MIXING

THE SAFEST OF ALL METHODS IS TO USE THE WET PROCESS TECHNIQUE, EVEN THOUGH IT IS MORE TIME CONSUMING AND COMPLICATED. THIS METHOD GENERALLY WILL KEEP YOU OUT OF THE HOSPITAL.

THE THEORY OF A WET PROCESS IS TO DISSOLVE OR SUSPEND THE CHEMICALS IN A SOLUTION DURING MIXING. THE RESULTING PASTE IS THEN DRIED OUT TO PRODUCE THE FINAL POWDER.

SEVERAL MAJOR PROBLEMS ARE PRESENT IN THE WET PROCESS. ALUMINUM WHEN MIXED WITH WATER PRODUCES EXPLOSIVE HYDROGEN GAS. THE SECOND PROBLEM IS THAT SOME OF THE CHEMICALS, ESPECIALLY SULPHUR, DO NOT DISSOLVE. I.E. SULPHUR IN A FORMULA SHOULD BE THE LAST CHEMICAL ADDED TO THE SLURRY AND THE RESULTING PASTE THAT YOU OBTAIN.

SECONDARY PROCEDURE

WEIGH OUT THE CHEMICALS AND PLACE IN A BOWL, SPREADING EVENLY WITH THE NON-SPARKING CONDUCTIVE SPATULA. DAMPEN THE POWDER WITH A SMALL QUANTITY (A SMALL PERCENT, 2 OR 3%), USING ABSOLUTE ALCOHOL. CARBON BLACK IS NOW ADDED TO THE BOWL. WEIGH OUT THE ALUMINUM POWDER AND ADD AS THE LAST INGREDIENT. GENTLY, SLOWLY, STIR FOR 3-5 MINUTES USING THE SPATULA. THE CARBON BLACK ADDS A SAFETY FEATURE FOR THE POSSIBILITY OF A STATIC ELECTRICITY SPARK.

KEEP IN MIND THAT ALL COMBINED MIXTURES UNDER MOTION ARE MUCH MORE DANGEROUS THAN WHEN AT REST.

SAMPLES OF QUIESCENT MATERIAL DURING MIXING CAN FORM SMALL INVISIBLE CLOUDS AND GENERATE ENERGY AND VOLTAGE OVER A WIDE GRADIENT OF AIR GAPS. THIS SET OF CIRCUMSTANCES PRESENTS AN EXTREMELY DANGEROUS HAZARD, ESPECIALLY IF THE MIXTURE MATERIAL HAS EXTREMELY FINE ALUMINUM. THIS ALUMINUM CLOUD SOMETIMES IS NOT VISIBLE TO THE NAKED EYE.

THE DESIRED VENTILATION IS AN OPEN WINDOW OR GARAGE DOOR ON A LIGHT AIR DAY, NOT STILL AIR OR A TORNADO. ELECTRIC FAN, WHOA ! - ELECIRIC.

THIS FINE ALUMINUM CLOUD IS ALWAYS THERE UNLESS YOU HAVE VERY MODERATE VENTILATION TO REMOVE IT FROM YOUR WORK AREA. SOMETIMES A PERSON 10 FT. AWAY WILL SEE IT IN THE SUN'S RAYS. SOME PLATELETS TAKE SEVERAL HOURS TO SETTLE.

! PURPOSELY, WE DID NOT DISCUSS GERMAN BLACK PYRO BECAUSE OF THE RESTRICTION OF PURCHASE AND THE PEOPLE WHO CHECK ON SALES OF THIS PRODUCT. !

TECHNICAL DATA NO. 1

THUNDER (FLASH REPORT)

THUNDER IS THE NOISE CREATED BY THE EXPLOSION OF A COMPOSITION AND WHICH EMOTIONALLY INCREASES THE ACTIVITY OF THE FIREWORKS DISPLAY. THE COMPOSITION, WHICH ALSO PRODUCES A FLASH EFFECT, IS CALLED "THUNDER FLASH"

THUNDER FLASH:	NO. 1 THUNDER FLASH	NO. 2 THUNDER FLASH	NO. 3 THUNDER FLASH	NO. 4 THUNDER FLASH
POTASSIUM CHLORATE	43%	-%	-%	-%
POTASSIUM PERCHLORATE	-	50	64	72
SULPHUR	26	27	13	-
ALUMINUM(FINE FLAKE)	31	23	23	28

THE THUNDER FLASH NO. 1 IS A CHLORATE COMPOSITION. THIS IS EASILY IGNITED AND IT EXPLODES PERFECTLY EVEN IN A RELATIVELY SMALL TURN OF KRAFT PAPER WITHOUT GLUE OR ANY CONTAINER. THERE IS NO NEED FOR A STRONG CAPSULE. THIS KIND OF COMPOSITION IS THEREFORE MOST POPULARLY USED AT PRESENT IN JAPAN FROM THE COMMERCIAL STANDPOINT. IT IS SENSITIVE TO SHOCK AND FRICTION, AND MORE RECENTLY, THE CHLORATE HAS BEEN GRADUALLY REPLACED BY PERCHLORATE, WHICH INCREASES THE STABILITY OF THE COMPOSITION.

FORMULA NO. 2 IS RELATIVELY WELL IGNITED AND ONE OF THE MORE POPULAR FORMULAS USED. FORMULA NO. 3 PRODUCES THE LOUDEST NOISE. FORMULA NO. 4 CONTAINS NEITHER SULPHUR NOR SULPHIDE AND THUS PRODUCES A SLIGHTLY SMALLER NOISE THAN THE FIRST THREE, BUT IT IS THE SAFEST OF ALL, TO HANDLE.

TECHNICAL DATA NO.2

DETONATION VELOCITIES OF REPORT COMPOSITIONS

	NO. 1	NO. 2	NO. 3
POTASSIUM PERCHLORATE	70	64	72
ALUMINUM (FINE FLAKE)	27	23	28
SULPHUR	3	13	-

DETONATION VELOCITIES ELECTRIC DETONATION	NO. 1	NO. 2	NO. 3
FEET-PER-SECOND	4655 FPS.	4687 FPS.	4013 FPS.

CONSTRUCTION OF SALUTES

THE EXPERIMENTER WHO HAS READ ENOUGH AND MIXED SOME OF THE PRECEDING FORMULAS, SHOULD NOW BE WELL AWARE OF THE DIRECTION IN WHICH HE WANTS TO PROCEED.

ITEMS FOR CONSTRUCTION

1. BROWN KRAFT PAPER
2. WHITE GLUE
3. SAWDUST
4. HOT GLUE GUN*
5. ARRAY OF PAPER OR SPIRAL-WOUND TUBES (SOURCE - LARGE TUBE - DRY GOODS STORE - BULK NEWSPRINT.
6. QUALITY FUSE
7. PLUGS & DOWEL RODS
8. CHEAP COPY PAPER
9. CUTTING KNIFE

* HOT GLUE GUN - NEVER USE ON A SALUTE END CAP THAT IS ALREADY LOADED WITH FLASH COMPOSITION.

A. SMALL SALUTES WITH THIN WALLS AND LITTLE CONTAINMENT REQUIRE FAST IGNITION FLASH POWDER.

B. MEDIUM SIZE SALUTES AND SMALL AERIAL BOMBS WILL PERFORM WITH SLOWER BURNING FLASH COMPOSITIONS.

C. LARGE "KA-BOOMS", REQUIRE HEAVY WALL TUBES, VERY SECURE END CAPS AND WORK BETTER WITH MEDIUM TO SLOW IGNITION COMPOSITIONS.

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GENERAL PRINCIPLES TO REMEMBER

1. HOT FLASH IS MORE DANGEROUS TO MIX, STORE AND USE IN CONSTRUCTION OF SALUTES.

2. MEDIUM IGNITION FLASH IS USUALLY SAFER TO MAKE AND STORE BUT REQUIRES MORE CONSTRUCTION AND TIME ON YOUR SALUTE DEVICE.

3. LARGE GROUND AND AERIAL BOMBS USE THE SAFER FORMULAS, INCLUDING BETTER STORAGE. CONSTRUCTION OF THIS TYPE OF DEVICE SHOULD BE SLOW AND THOUGHT OUT AS YOU ARE NOW GETTING IN BLAST AND SHOCK WAVE DESTRUCTION. AN ACCIDENT OR MISCALCULATION COULD BE DISASTROUS.

HOME-MADE TUBES CAN BE CONSTRUCTED BY USING A DOWEL ROD OR OTHER CYLINDRICAL DEVICE OF DESIRED DIAMETER AND ROLLING KRAFT PRECUT PAPER AROUND THE TUBE. RUN A BEED OF WHITE GLUE WHEN 1/2 ROLLED AND FINISH ROLLING AND SEAL EDGE WITH ADDITIONAL GLUE. LET DRY AND CUT TO DESIRED LENGTH. HARD CARDBOARD IN SINGLE AND DOUBLE STRENGTH MAKES GOOD END PLUGS.

NORMALLY FILL ALL DEVICES APPROXIMATELY 1/3 TO 40% FULL OF THE COMPOSITION BEING USED.

COMMERCIAL VISCO FUSE IS THE BEST CHOICE FOR MOST SALUTES UNLESS YOU ARE GOING TO USE ELECTRIC IGNITION. ALWAYS BURN A SEGMENT OF THE FUSE TO DETERMINE SECONDS PER INCH OR FOOT THAT IS REQUIRED. IT IS POSSIBLE TO MAKE FUSE BUT THE BURN TIME IS VERY ERRATIC.

NOTE: DO NOT GET CARELESS BECAUSE YOU HAVE PURCHASED FIREWORKS AT STANDS AND HAVE NOT EXPERIENCED PROBLEMS. SEVERAL OF THESE FACTORIES IN THE LAST FEW YEARS BLEW UP COMPLETELY MAKING THEIR CLASS "C" POPPERS. (AN ASSEMBLY LINE MISTAKE THROUGH CARELESSNESS CAUSED AT LEAST ONE OF THESE DISASTERS WHICH KILLED SEVERAL PEOPLE.)

WHEN YOU HAVE FINISHED A PERIOD OF EXPERIMENTATION, YOU WILL, BY KEEPING RECORDS, BEGIN TO LEARN HOW TO IMPROVISE IN BUILDING AND FINDING VARIOUS CONTAINMENT DEVICES.

FROM THIS POINT ON, USE COMMON SENSE AND NEVER GET CARELESS OR IN A HURRY. (FLYING ROCKS OR DEBRIS IS ALWAYS A HAZARD. TAKE COVER AND PROTECT YOUR EYES AND EARS.)

SOURCES OF CHEMICALS

TRACEY SCIENTIFIC LABS INC.
P.O. BOX 615
EVANSTON, ILLINOIS 60204

WESTECH CORP.
BOX 8193
SALT LAKE CITY, UTAH 84108

FREEDOM PYRO SUPPLY
ROUTE 3, BOX 163
MINERAL POINT, WI. 53565

SLE INC.
BOX 3673
LOGAN, UTAH 84321

CAPITOL FIREWORKS CO.
1805 W. MONROE
SPRINGFIELD, ILL. 62704

COONIE'S EXPLOSIVES & BLACK POWDER
BOX 2062
HOBBS, NEW MEXICO 88240

LABORATORY SALES
P.O. BOX 161
BRIGHTON, MASS.

LEGALITY OF HOME-MADE FIREWORKS

IT WOULD BE ADVISABLE TO A PERSON WHO EXPECTS TO ENGAGE IN THE ACTIVITY DESCRIBED IN THIS BOOK, TO CONSIDER SUBSCRIBING TO THE "AMERICAN FIREWORKS NEWS" - STAR ROUTE - BOX 30, DINGMAN'S FERRY, PA. 18328. IF YOU DECIDE TO GO THIS FAR, YOU MIGHT ALSO CONSIDER BECOMING A MEMBER OF THE AMERICAN FIREWORKS GUILD. THIS INFORMATION IS OBTAINED THROUGH THE ABOVE ADDRESS. SOME STATES OR GEOGRAPHIC REGIONS HAVE THEIR OWN AMATEUR FIREWORKS CLUBS. THIS CAN LEND SOME CREDENCE & LEGALITY TO YOUR HOME EXPERIMENTATIONS. FIREWORKS DEVICES THAT CONTAIN MORE THAN 2 GRAMS OF PYROTECHNIC COMPOSITION ARE PROHIBITED BY FEDERAL LAW. MANY STATES AND LOCAL GOVERNMENTS HAVE ADDITIONAL FIREWORKS REGULATIONS.

YOU SHOULD BE APPRISED THAT SEVERE PENALTIES, ESPECIALLY FEDERAL, ARE ON THE BOOKS WHICH WILL GIVE YOU NO END OF TROUBLE IF YOU PARTICIPATE IN ILLEGAL FIREWORKS MANUFACTURING.

IF YOU BECOME SERIOUS ABOUT YOUR EXPERIMENTS AND ENJOY PYROTECHNICS, YOU SHOULD SEEK ADDITIONAL INFORMATION FROM THE VARIOUS FIREWORKS CLUBS & ORGANIZATIONS ABOUT BECOMING A LEGAL PARTICIPANT. FEDERAL CLASS "B" LICENSE IS NOT DIFFICULT TO OBTAIN IF YOU HAPPEN TO HAVE A SEMI-RURAL SETTING.

* PLEASE USE COMMON SENSE, BE CAREFUL, AND ASK QUESTIONS FROM ADVANCED PYROTECHNICIANS...